ISSN 2644-3228 (online)

Artificial Intelligence in *Cancer*

Artif Intell Cancer 2021 April 28; 2(2): 7-24

Published by Baishideng Publishing Group Inc

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Artificial Intelligence in Cancer

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Bimonthly Volume 2 Number 2 April 28, 2021

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Artificial Intelligence in Cancer

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Editorial Board Member of *Artificial Intelligence in Cancer*, Ravi P Sahu, PhD, Assistant Professor, Department of Pharmacology and Toxicology, Boonshoft School of Medicine Wright State University, Dayton, OH 45345, United States. ravi.sahu@wright.edu

AIMS AND SCOPE

The primary aim of *Artificial Intelligence in Cancer* (*AIC*, *Artif Intell Cancer*) is to provide scholars and readers from various fields of artificial intelligence in cancer with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

AIC mainly publishes articles reporting research results obtained in the field of artificial intelligence in cancer and covering a wide range of topics, including artificial intelligence in bone oncology, breast cancer, gastrointestinal cancer, genitourinary cancer, gynecological cancer, head and neck cancer, hematologic malignancy, lung cancer, lymphoma and myeloma, pediatric oncology, and urologic oncology.

INDEXING/ABSTRACTING

There is currently no indexing.

RESPONSIBLE EDITORS FOR THIS ISSUE

NAME OF JOURNAL
Artificial Intelligence in Cancer

ISSN
ISSN 2644-3228 (online)

LAUNCH DATE
June 28, 2020

FREQUENCY
Bimonthly

EDITORS-IN-CHIEF
Mujib Ullah, Cedric Coulouarn, Massoud Mirshahi

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PUBLICATION DATE
April 28, 2021

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Artif Intell Cancer 2021 April 28; 2(2): 7-11

DOI: 10.35713/aic.v2.i2.7

ISSN 2644-3228 (online)

EDITORIAL

Artificial intelligence and colorectal cancer: How far can you go?

Rita Alloro, Emanuele Sinagra

ORCID number: Rita Alloro 0000-0003-1237-3878; Emanuele Sinagra 0000-0002-8528-0384.

Author contributions: Sinagra E and Alloro R designed the study and wrote the manuscript.

Conflict-of-interest statement: All the authors declare that this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors, and thus there is no conflict of interest regarding this paper.

Manuscript source: Invited manuscript

Specialty type: Gastroenterology and hepatology

Country/Territory of origin: Italy

Rita Alloro, Department of Surgical, Oncological and Oral Sciences (Di.Chir.On.S.), Unit of General and Oncological Surgery, Paolo Giaccone University Hospital, University of Palermo, Palermo 90127, Italy

Emanuele Sinagra, Gastroenterology and Endoscopy Unit, Fondazione Istituto G. Giglio, Palermo 90015, Italy

Corresponding author: Emanuele Sinagra, PhD, Attending Doctor, Gastroenterology and Endoscopy Unit, Fondazione Istituto G. Giglio, Contrada Pietrapollastra Pisciotto, Cefalù, Palermo 90015, Italy. emanuelesinagra83@googlemail.com

Abstract

Artificial intelligence is an emerging technology whose application is rapidly increasing in several medical fields. The numerous applications of artificial intelligence in gastroenterology have shown promising results, especially in the setting of gastrointestinal oncology. Therefore, we would like to highlight and summarize the research progress and clinical application value of artificial intelligence in the diagnosis, treatment, and prognosis of colorectal cancer to provide evidence for its use as a promising diagnostic and therapeutic tool in this setting.

Key Words: Artificial intelligence; Colorectal cancer; Diagnosis; Treatment; Prognosis

Core Tip: In this editorial, we would like to highlight and summarize the research progress and clinical application value of artificial intelligence in the diagnosis, treatment, and prognosis of colorectal cancer to provide evidence for its use as a promising diagnostic and therapeutic tool in this setting.

Citation: Alloro R, Sinagra E. Artificial intelligence and colorectal cancer: How far can you go? *Artif Intell Cancer* 2021; 2(2): 7-11

URL: https://www.wjgnet.com/2644-3228/full/v2/i2/7.htm

DOI: https://dx.doi.org/10.35713/aic.v2.i2.7

Peer-review report's scientific quality classification
Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

Received: March 24, 2021
Peer-review started: March 24, 2021
First decision: March 26, 2021
Revised: April 1, 2021
Accepted: April 20, 2021
Article in press: April 20, 2021
Published online: April 28, 2021

P-Reviewer: Yau TO
S-Editor: Wang JL
L-Editor: A
P-Editor: Yuan YY

INTRODUCTION

Colorectal cancer (CRC) is a major healthcare concern worldwide. It is the third most common cancer in males, the second most common cancer in females and the fourth leading cause of cancer death worldwide[1-3]. Furthermore, up to 60%-70% of recognized cases in symptomatic patients are diagnosed at an advanced stage[4-6].

Artificial intelligence (AI) is a form of machine technology in which intelligent agents perform functions associated with the human mind, such as learning and problem solving[7-9]; AI algorithms are primarily used for disease diagnosis, treatment and prognosis[10,11].

In the setting of endoscopic diagnosis, AI has been primarily evaluated in 3 clinical scenarios: Polyp detection, polyp characterization (adenomatous *vs* nonadenomatous), and the prediction of invasive cancer within a polypoid lesion[12].

With regard to polyp detection, the adenoma detection rate (ADR), defined as the proportion of patients with at least one colorectal adenoma detected at the first screening colonoscopy among all the patients examined by an endoscopist, represents a pivotal quality measure for colonoscopy[6,13]. In fact, it has been reported that a 1% increase in the ADR is associated with a 3% decrease in interval CRC incidence[6,14,15].

The outcomes reported by different mono- and multicenter randomized clinical trials are highly promising; the overall ADR of these studies was significantly higher when computer-aided diagnosis (CAD) systems were incorporated (up to 80%)[16-20].

With regard to polyp characterization, CAD systems can achieve thresholds of preservation and incorporate valuable endoscopic innovations for diminutive, nonneoplastic rectosigmoid polyps according to various studies[6,21-25].

With regard to differentiation between invasive cancer and nonmalignant adenomatous polyps, an accuracy of 94.1% and 81,2%, respectively, was achieved in two recent studies[26,27].

AI has also been evaluated in the classification and diagnosis of biopsy samples. In a recent systematic review performed by Thakur and coworkers, the authors concluded that artificial intelligence showed promising results in terms of accuracy in diagnosing CRC with regard to tumor classification, tumor microenvironment analysis, and prognosis prediction. However, the scale and quality of the training and validation datasets of most of these studies are insufficiently adequate, limiting the applicability of this technique in clinical practice[28].

With regard to surgical approaches, robot-assisted colorectal surgery has shown better performance than human-alone surgery, in terms of short- and long-term outcomes[10,29].

Additionally, with regard to the pharmacological approach, some studies evaluated targeted drug delivery[30], drug pharmacokinetics[31] and prediction of the rate of drug toxicity[32].

Furthermore, the personalization and precision of cancer treatments have become major themes in oncology research. For example, "Watson for Oncology" is an AI system that can assist in the precision medicine-based treatment of tumors[10,33]. It can automatically extract medical language from doctors' records and translate them into a practical language for learning[10]. This model can be used to identify new cancer sub-populations, analyze their genetic biomarkers, and find effective drug combinations[10].

Finally, the emergence of AI has allowed clinicians to predict the prognoses of CRC patients more easily and precisely by using several approaches. For example, in one study, genetic markers of CRC were used to train a model based on different algorithms[34]. In another study, a computer-aided analysis method for tissue sections based on multifractal analyses of cytokeratin-stained tumor sections was proposed to evaluate the complexity of tumor-stroma interfaces[35]. Other studies have evaluated cytokeratin immunohistochemical images to predict lymph node metastasis[36,37] and the infiltration of immune cells in influencing CRC prognosis[38].

In the near future, AI technology will help doctors diagnose and treat their patients and provide CRC patients with personalized and accurate prognosis evaluations.

CONCLUSION

In conclusion. AI could play a pivotal role in gastrointestinal oncology, especially in the setting of CRC, for tailoring patient treatments and predicting their clinical outcomes[9].

Table 1 Application of artificial intelligence in colorectal cancer

Setting	Application	Ref.
Diagnosis	Polyp identification	[16-20]
	Polyp characterization	[21-25]
	Prediction of invasive cancer within a polypoid lesion	[26,27]
	Search for new diagnostic biomarkers	[10]
	Pathologic biopsy	[28]
Treatment	Preoperative evaluation	[10]
	Robot-assisted surgery	[29]
	Drug delivering in a targeted manner	[30]
	Evaluation of drugs pharmacokinetic	[31]
	Prediction of the rate of toxicity	[32]
	Watson for Oncology project	[33]
Prognosis	Search for new prognostic biomarkers	[38]
	Evaluation of tumour-stroma ratio	[35]
	Prediction of lymph-node metastasis	[36,37]

Future randomized studies could directly increase the overall value (quality and costs) of AI by examining its effects not only in diagnosis (by evaluating colonoscopy findings, endoscopy durations, polyps and ADRs) but also in prognosis and therapy.

Since AI science continues to grow and evolve, the current limitations must be considered as a future challenge; these limitations are also inherited by the medicine applications of AI, including the difficult predictability of situations characterized by some degree of uncertainty[6]. Table 1 shows the applications of AI in CRC.

Future applications of AI could be implemented in all the settings of CRC management, such as the determination of the potential role of noncoding RNAs in tumor diagnosis and treatment[10].

Finally, the integration of AI in human-based medicine has to considered. AI has never been nor will ever be considered a substitute for the physician; on the contrary, it seems to be an extremely helpful tool to be used by the physician who, given his or her ability and skills, is the only one able to process and interpret all the information extracted by the AI to make decisions on patient management.

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